



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No. : 09/863,872 Confirmation No.: 9481
Applicant : Stefan BONEBERG
Filed : May 24, 2001
TC/A.U. : 1764
Examiner : Thanh P. DUONG
Docket No. : 1748X/49969US
Customer No. : 23911
Title : Method for Operating a Gas Generation Device in a Fuel Cell System

APPEAL BRIEF UNDER 37 C.F.R. §41.37

Mail Stop Appeal Brief
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

May 1, 2006

Sir:

Appellants submit this Appeal Brief, pursuant to 37 C.F.R. §41.37, pursuant to the Notice of Appeal filed December 13, 2005. A one month's extension of time Petition under 37 C.F.R. §1.136(a) is submitted herewith, together with the appropriate fee.

05/02/2006 AKELECHI 00000032 09863872

01 FC:1251
02 FC:1402

120.00 OP
500.00 OP

I. REAL PARTY IN INTEREST

This application has been assigned by the inventors to XCELLSIS GmbH, a German company, and is now owned by NuCellSys GmbH, a German company. Accordingly, the real parties in interest to the present appeal are the named inventors and NuCellSys GmbH.

II. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to Appellants, to Appellants' legal counsel or to the assignee which will directly affect or be directly affected by or have a bearing on the Board's decision in this Appeal.

III. STATUS OF CLAIMS

Claims 1-13 are currently pending in this application. Of these, claims 2 and 13 have been objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form. Claims 1 and 3-12, on the other hand, have been rejected on prior art grounds. By this Appeal, Appellants seek review of the final rejection of claims 1 and 3-12

IV. STATUS OF AMENDMENTS

Two amendments have been submitted with respect to the present application, dated April 11, 2005 and October 7, 2005. The amendment dated April 11 has been entered. However, an Advisory Action issued November 4, 2005, indicated that amendment submitted October 7 would not be entered for

the purpose of appeal. The only change made by that amendment was the correction of a typographical error in claim 12, in which the word "unit" had been omitted from the phrase "gas generation unit," which is otherwise used consistently throughout the claims. On May 1, 2006, Counsel discussed this matter with the Examiner in a telephone interview, and the Examiner indicated that he had not intended to withhold entry of this correction in the event of an appeal. Accordingly, it is Appellants' understanding that the Examiner will enter a telephone Interview Summary indicating that the October 7, 2005, amendment would be entered for the purpose of appeal. Since no issue has been raised under 35 USC §112 regarding claim 12, this matter is not discussed further herein.

V. SUMMARY OF THE CLAIMED SUBJECT MATTER

The present invention is directed to a method of operating a gas generating device which includes at least two gas generating units that are arranged sequentially in a gas flow path, as depicted, for example, in Figures 1a and 1b. It is noted in this regard that Figures 1a and 1b depict a first embodiment of the invention, which may be taken as representative for the purpose of the present appeal. The only difference between Figures 1a and 1b is the indicated operating temperatures of respective heaters 12a and 12b, Figure 1a showing their status during a start-up operation and Figure 1b showing their status at steady state.

As can be seen in Figure 1a, fuel from a fuel tank 8 and water from a water tank 10 are evaporated in respective evaporators 9, 11, combined and fed to a first gas generator 2a. From there they flow through a second gas generator 2b, which provides a hydrogen rich gas output that flows through a gas cleaning unit 3 (which oxidizes carbon monoxide to generate carbon dioxide), after which they are fed to a fuel cell 4. As indicated in paragraphs [0007] and [0023], the first gas generator unit 2a has a lower thermal mass than that of the second gas generation unit 2b, so that it heats more rapidly in response to the input of a given quantity of heat.

The method according to the present invention defines a manner of operation of such a system, which achieves improved cold starting properties. That is, the device is quickly brought to an operating temperature at which it achieves its full capacity for generating hydrogen gas. For this purpose, according to a feature of the invention, during a starting operation, only the upstream gas generation unit (2a in Figure 1) is heated (by an external heat source in Figures 1a and 1b), so that only that gas generation unit is operated. In order to hasten the heating of first gas generation unit, during the starting phase, it is operated with a power and/or at a temperature that exceeds the rated power of the unit. Thus, claim 1 recites a step as follows:

during a starting phase of the gas generation device,
operating only the first gas generation unit, with a power
 $P_{start\ 1} > P_{rated\ 1}$ or at an operating temperature $T_{start\ 1} > T_{rated\ 1}$.

VI. GROUNDS OF REJECTION

Claims 1 and 3-12 has been rejected under 35 USC §103(a) as unpatentable over Benz et al. (U.S. Patent No. 6,187,066), in view of European patent application EP 09689581 A1 ('958).

VII. ARGUMENT

The Benz *et al.* reference differs from the present invention in the following particulars:

- (1) it does not disclose a method of operating a gas generating unit; and
- (2) it does not provide that one of two gas generation units is operated during a cold start with a power output which exceeds its rated power.

Gas Generation versus Heater

Gas generation, as referred to in the present application (for example, a "reforming reaction"), is endothermic. It does not constitute, and is not functionally equivalent to, "combustion," and requires a source of heat in order to sustain it. Such heat may be supplied by an electric source, by combustion or in any other manner. The manifest purpose of a gas generator is to generate a gas which is used as a fuel for some other system.

The Benz *et al.* reference is directed to a device for providing heat energy -- that is, a "heater," the output of which is heat. The specification confirms this point at numerous places. Thus, for example, the Abstract indicates that it is a "device for providing heating energy to a gas-generating system." (It is apparent,

of course, that there is a difference between such a device for providing heat, typified by Benz *et al.*, and the gas-generating system itself, such as that of the present invention.) See also, column 1, lines 677, and column 2, lines 40-41. Accordingly, each of the three components 2-4 in Figure 1 (for example) of Benz *et al.* constitutes a "combustion chamber." (See column 2, lines 45 and 63; column 3, lines 2-3 and 14-16.) The manifest purpose of such combustion is to generate heat.

In response to the above summarized matters, the Advisory Action states (on the continuation page) that the claims of the present application do not distinguish over Benz *et al.* because:

1. Benz *et al.* discloses a device for generating hydrogen; and
2. Hydrogen is a source of heat energy.

Appellants respectfully submit, however, that the first of these two propositions is incorrect, and that the second is irrelevant. In particular, the specification at column 1, lines 6-9 of Benz *et al.*, referred to in the Office Action clearly belies the notion that Benz *et al.* disclose a method of operating a gas generation device, stating that "the invention relates to a device for providing heat energy for a gas generating system..." It thus clearly differs from the gas generating system itself, for which heat is to be provided.

The proposition, on the other hand, that hydrogen gas can be a source of heat energy, has no bearing on the claims of the present application, which are directed to a method of operating a gas generating system. In contrast to the present application, Benz *et al.* is directed to a device which consumes fuel (for

example, hydrogen) in order to generate heat. For this purpose, as described at column 2, line 40 through column 3, line 34, a mixture of fuel and oxygen is passed through a series of combustion chambers contained in components 2-4 where it is catalytically reacted to generated heat. "The completely oxidized fuel-air mixture is finally discharged into the environment through the second line 6." Benz *et al.* clearly does not disclose a method of operating a gas generator.

Appellants note in this regard, that the phrase "gas generator" is a well defined term of art, which is understood by those skilled in the art, as can be verified, for example, by a computer search of the search "gas generator." (See, for example, www.kohlerpowersystems.com/omsite_gas.html.) The fact that the heater unit disclosed in Benz *et al.* has an exhaust which outputs exhaust gases does not make it a "gas generator" within the meaning of that term as it is used in the present application, any more than the proposition that a steam locomotive produces steam makes it a gas generator, or that an automobile is a gas generator because it has an exhaust for waste gases.

Operation at a Power Level above Rated Power

Claim 1 also recites that during a starting phase of the gas generation device, only the first of two gas generation units is operated, with a power that exceeds the rated power of the unit P_{rated_1} . This feature of the invention is also neither taught nor suggested, nor even addressed, in Benz *et al.*.

As is known to those skilled in the art, the capacity of a given gas generation unit to produce hydrogen gas (referred to as its "power" output)

increases with its operating temperature, and the actual instantaneous power output at a given temperature is a function of the rate at which fuel is supplied (until, of course, the fuel supply exceeds the capacity of the unit). The specification of the present invention defines the "rated power" of a gas generator as the amount of hydrogen gas that it is capable of producing "during prolonged operation at full load." See paragraph [0022]. Those skilled in the art will understand that the rated power of a gas generator is a function of its composition and structure, and that, for a particular gas generator, its "rated power" will have a corresponding rated temperature -- being the temperature at which the "rated power" is achieved.

It is, of course, apparent that a particular gas generator may be operated for short periods of time at a power output that it is incapable of sustaining over a prolonged period without incurring damage or deterioration -- that is, a power output that exceeds its "rated power." Such "overload" operation (paragraph [0024], lines 9-10) results in rapid heating of the gas generator unit. The present invention takes advantage of this phenomenon in order to provide an overall gas-generating system that is capable of rapidly achieving an operating temperature. The penultimate paragraph in both claims 1 and 12 recites this feature of the invention. Claim 1 states, for example, that "during a starting phase of the gas generation device, ...only the first gas generation unit [is operated], with a power $P_{start_1} > P_{rated_1}$, or at an operating temperature $T_{start_1} > T_{rated_1}$."

The disclosure in Benz *et al.* at column 4, lines 1-4, does not teach this aspect of the invention. Rather, it simply notes that after the system has

warmed up, the cold start component 3 is not operated at all (no fuel/air mixture is conducted through it). Since the output of the cold start unit during normal operation is thus zero, it follows that any level of operation during cold starting exceeds the actual level at which the cold start unit is operated (zero) when the system has been warmed up. This proposition is quite different, however, from stating that during cold starting, the cold start component 3 is operated "above its rated power," as defined in paragraph [0022]. In other words, the fact that the cold start unit 3 is operated at zero power output during warmed up operation of the overall system, does not mean that its rated power is zero, which is the tacit premise of the statement set forth at the top of page 7 of the Office Action. Nothing contained in EP '958 suggests such "overload" operation, or a modification of Benz *et al.*, which would replicate the present invention. Accordingly, for the reasons set forth above, Appellants respectfully submit that both of claims 1 and 12, and therefore all claims which remain of record, distinguish over the Benz *et al.* and EP '958 references.

The Final Office Action (page 2, last line, and continuing onto page 3) indicates that during a starting phase of the heater unit in Benz *et al.*, the first gas generation unit is operated with power $P_{start_1} > P_{rated_1}$, or at an operating temperature $T_{start_1} > T_{rated_2}$, referring to the specification at column 3, lines 49-53, and column 3, line 58-through column 4, line 5. However, the first of these two portions of the specification (column 3, lines 49-53) states only that at cold start, a reduced quantity of fuel/air mixture is conducted via a cold start component 3 which includes an electrical heating device so that the reaction

begins quickly in that unit, while the reaction does not yet begin in the central component. Although this language does suggest that the cold start component 3 operates initially by itself, it conveys no information which suggests that the cold start unit is operated at a power level or temperature which exceeds its rated power level or temperature, as recited in the claims. Moreover, the second of these two excerpts (column 3, line 58 through column 4, line 5) simply describes the manner of operation of the system after it has reached a predetermined operating temperature T_{des} . As noted, during such warmed up operation, the two-way valve 10 is switched, so that the fuel/air mixture bypasses the cold-starting component 3. By way of explanation, the specification further states that such a switch is necessary because during warmed up operation, no fuel/air mixture should be conducted through the cold-start component 3 since this would lead to overheating in the case of high fuel concentrations, and hence damage to the catalyst. While this language certainly supports the proposition that the cold start component is operated at a temperature during the starting phase which is greater than its temperature under warmed up operation (since no combustion at all takes place in the cold start component during normal on-going operation), it says nothing about the rated capacity of the cold start component, or the relationship between its rated capacity and its temperature during cold start operation.

VIII. CONCLUSION

For the reasons discussed in detail above, Appellants respectfully submit that claims 1-13 in the present application are patentable over the references of record. Accordingly, Appellants request that the Board reverse the final rejection of these claims, and allow the present application.

The Commissioner is hereby authorized to charge any deficiency, or credit any overpayment, to Deposit Account No. 05-1323, Docket No.: 1748X/49969.

Respectfully submitted,


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CLAIMS APPENDIX

Claim 1. A method for operating a gas generation device for a fuel cell system, said gas generation device having at least two gas generation units through which a starting-material stream flows in sequence, and which gas generation units have a first and second rated power P_{rated_1} , P_{rated_2} , and a first and second predetermined operating temperature, respectively, said method comprising:

providing the first gas generation unit with a lower thermal mass than the second gas generation unit;

during a starting phase of the gas generation device, operating only the first gas generation unit, with a power $P_{start_1} > P_{rated_1}$ or at an operating temperature $T_{start_1} > T_{rated_1}$; and

after the end of the starting phase, operating at least the second gas generation unit.

Claim 2. The method according to Claim 1, wherein:

after the starting phase has ended, in the event of a low and medium load, only the second gas generation unit is operated; and

the first gas generation unit is operated only when a required power exceeds the rated power P_{rated_2} of the second gas generation unit.

Claim 3. The method according to Claim 1, wherein:

the gas generation units are indirectly heated endothermic steam reforming units;

the first gas generation unit is operated during the starting phase at a temperature $T_{start_1} > T_{rated_1}$, and is supplied with at most a quantity of operating medium which corresponds to an instantaneously required power; and

after the end of the starting phase, the gas generation units are operated at predetermined operating temperatures.

Claim 4. The method according to Claim 1, wherein:

 during the starting phase, at least the first gas generation unit, is also supplied with an oxygen-containing medium in addition to the operating medium;

 at least the first gas generation unit is suitable for partial oxidation or for autothermal operation; and

 during the starting phase at most a quantity of operating medium or quantity of oxygen-containing medium which corresponds to the power P_{start_1} is supplied.

Claim 5. The method according to Claim 3, wherein after the end of the starting phase, the first gas generation unit is supplied with only a quantity of oxygen-containing medium which is reduced compared to the maximum quantity reached during the starting phase.

Claim 6. The method according to Claim 5, wherein no oxygen containing medium is supplied.

Claim 7. The method according to Claim 4, wherein after the end of the starting phase, upon occurrence of a predetermined load rise, the first gas generation unit is supplied with oxygen-containing medium for a predetermined time.

Claim 8. The method according to Claim 2, wherein after the end of the starting phase, the first gas generation unit is supplied with oxygen-containing medium only when a required power exceeds the rated power P_{rated_2} of the second gas generation unit.

Claim 9. The method according to Claim 4, wherein after the end of the starting phase, the first gas generation unit is supplied with oxygen-

containing medium only when a required power exceeds the rated power $P_{\text{rated_2}}$ of the second gas generation unit.

Claim 10. The method according to Claim 1, further comprising means for keeping the first gas generation unit warm during operational pauses.

Claim 11. The method according to Claim 1, wherein the starting phase has ended as soon as the components of the fuel cell system through which the product gas stream of the first gas generation unit flows have reached a predetermined operating temperature.

Claim 12. A method of generating fuel gas for a fuel cell system, comprising:

providing first and second gas generation units through which a reactant gas stream flows sequentially for generating said fuel gas, said first gas generation unit being upstream of said second gas generation unit, and having a thermal mass which is lower than a thermal mass of the second gas generation unit;

during a startup operating phase, operating only the first gas generation unit, with at least one of a power greater than a rated power thereof and an operating temperature greater than a rated operating temperature thereof; and

after completion of the startup operating phase, operating at least the second gas generation unit.

Claim 13. The method according to Claim 1, wherein:

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Reply to Office Action

after the starting phase has ended, in the event of a low and medium load only the second gas generation unit is operated; and

the first gas generation unit is operated only when a required power exceeds a rated power of the second gas generation unit is required.



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Atty. Dkt. No.: 10748X/49969US

EVIDENCE APPENDIX

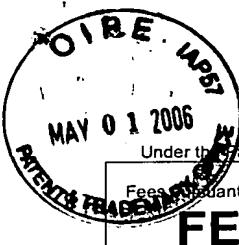
None.



U.S. Appln. Ser. No. 09/863,872
Atty. Dkt. No.: 10748X/49969US

RELATED PROCEEDINGS APPENDIX

None.



Apr / 1764
JRW

PTO/SB/17 (01-06)
Approved for use through 07/31/2006. OMB 0651-0032

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Effective on 12/08/2004.
Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL For FY 2006

Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT (\$) **620.00**

Complete if Known	
Application Number	09/863,872
Filing Date	May 24, 2001
First Named Inventor	Stefan BONEBERG
Examiner Name	Thanh P. Duong
Art Unit	1764
Attorney Docket No.	1748X.49969US

METHOD OF PAYMENT (check all that apply)

Check Credit Card Money Order None Other (please identify):
 Deposit Account Deposit Account Number: **05-1323 (Docket No. 102063.49969US)** Deposit Account Name: **23911**

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

Charge fee(s) indicated below Charge fee(s) indicated below, except for the filing fee
 Charge any additional fee(s) or underpayments of fee(s) Credit any overpayments
 under 37 CFR 1.16 and 1.17

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FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

<u>Application Type</u>	FILING FEES		SEARCH FEES		EXAMINATION FEES		
	<u>Small Entity</u>	<u>Fee (\$)</u>	<u>Small Entity</u>	<u>Fee (\$)</u>	<u>Small Entity</u>	<u>Fee (\$)</u>	<u>Fees Paid (\$)</u>
Utility	300	150	500	250	200	100	
Design	200	100	100	50	130	65	
Plant	200	100	300	150	160	80	
Reissue	300	150	500	250	600	300	
Provisional	200	100	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description

Each claim over 20 or, for Reissues, each claim over 20 and more than in the original patent

Small Entity

Fee (\$) Fee (\$)

50 25

Each independent claim over 3 or, for Reissues, each independent claim more than in the original patent

200 100

Multiple dependent claims

360 180

<u>Total Claims</u>	<u>Extra claims</u>	<u>Fees(\$)</u>	<u>Fee Paid (\$)</u>	<u>Multiple Dependence Claims</u>	
	-20 or HP	x	=	<u>Fee(\$)</u>	<u>Fee Paid (\$)</u>
HP = highest number of total claims paid for, if greater than 20					

<u>Indep. Claims</u>	<u>Extra claims</u>	<u>Fees(\$)</u>	<u>Fee Paid (\$)</u>	<u>Fee(\$)</u>	<u>Fee Paid (\$)</u>
- 3 or HP	x	=			

HP = highest number of total claims paid for, if greater than 3

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

<u>Total Sheets</u>	<u>Extra Sheets</u>	<u>Number of each additional 50 or fraction thereof</u>	<u>Fee (\$)</u>	<u>Fee Paid (\$)</u>
- 100 =	/ 50 =	Round up to a whole number	x	=

4. OTHER FEES

Petition for Extension of Time		<u>Fee Paid (\$)</u>
Appeal Brief		\$120.00

\$120.00

\$500.00

SUBMITTED BY		Registration No. (Attorney/Agent)	Telephone
Signature	<i>Gary R. Edwards</i>	31,824	(202) 624-2500
Name (Print/Type)	Gary R. Edwards	Date	May 1, 2006

This collection of information is required by 37 CFR 1.136. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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